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Making Land Produce USEFUL WILDLIFE



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YOU CAN HAVE wildlife on your land and have a better farm or ranch because of it. Every farm is a complex community which is successful only if all the living things in it are working together. What you can do on your own land to maintain the most desirable biologic balance is described in this bulletin.

In the days ahead we must use our land wisely and productively. It must provide the food, fats, oils, and fibers needed for an expanding population and for securing our position in world affairs. We must produce in quantity without permanent damage to the soil. And at the same time we must look to the land for recreation and relaxation. Our farms and ranches can provide hunting, fishing, trapping, and the esthetic values inherent in a well-balanced landscape and the fish and wildlife it supports. These things can be achieved through attention to the land treatment suggested in this bulletin.

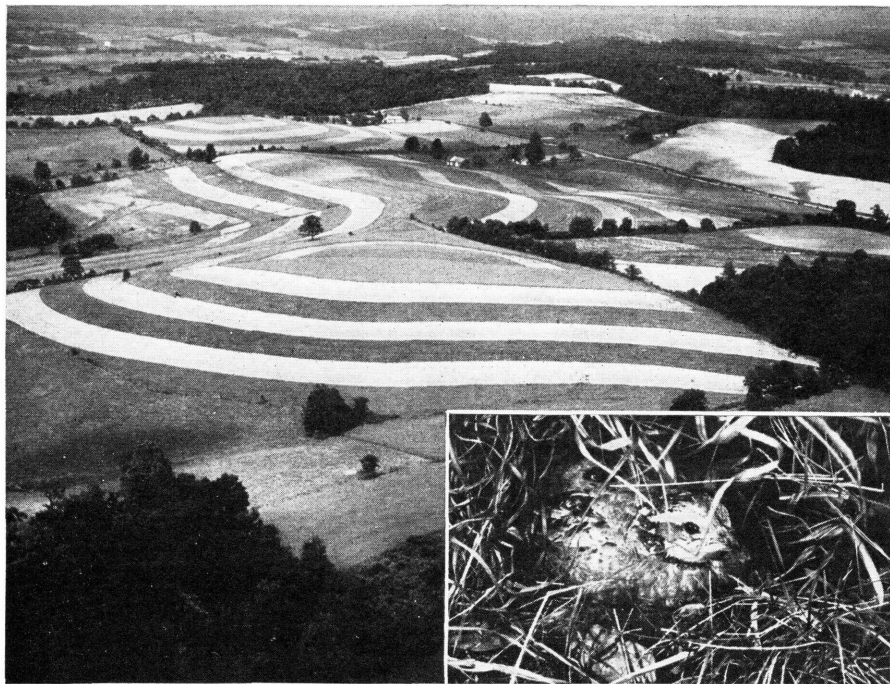
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Making Land Produce Useful Wildlife

By WALLACE L. ANDERSON, *regional biologist, Upper Mississippi Region, Soil Conservation Service.* Drawings by FELIX SUMMERS.



EVERY FARM is a complex living community based on the soil. Working with the soil, and dependent on it, are plants and animals that convert plant nutrients, moisture, and sunshine into food and fiber for man. It is a successful community only if all the living things in it are working for the benefit of the whole community.

If there are not enough grasses in the community, the soil loses its ability to take up and hold moisture.

It may become eroded and lose its power to produce corn for hogs. If there are not enough earthworms, the same thing can happen. If there are not enough squirrels, there will be fewer acorns planted and in time there will be fewer oaks. If there are not enough cottontails—one of whose functions is to feed foxes—foxes may look to the farmer's poultry for food.





On the other hand, if there are too few foxes to eat meadow mice, there may be so many meadow mice that there will be less alfalfa for dairy cows. If there are not enough songbirds, there may be too many destructive insects, resulting in a shortage of grain for beef cattle.

But there must be useful insects to pollinate alfalfa, red clover, and sweet-clover, else these legumes will not produce seed.



Thus we see that a successful farm community must have an abundance of useful wildlife and a low number of the harmful kinds. It must have what is called a *favorable biologic balance*.

A system of farming that supports a family well without depleting basic resources has a favorable biologic balance. Conversely, farming that depletes the soil and results

in plagues of insects, weeds, and crop diseases has an unfavorable biologic balance.

You may be surprised at the wildlife population living on well-managed farms. Studies made on Ohio farms having soil conservation plans in effect tell the story. On a 100-acre farm with about one-third of the fence rows in woody cover, 15 acres in protected woods, 25 acres in good pasture, and 60 acres in a 4-year rotation with 2 years of meadow, the useful wildlife population was estimated to be:

Several million beneficial insects, mostly destroyers of other insects and some that help to pollinate fruits and legumes. *More than 400 beneficial birds*, of 40 kinds. *More than 1,000 beneficial small mammals*, many of which are effective insect destroyers.



Also present on well-managed farms in various parts of the country are the adapted game birds and animals—quail, pheasants, grouse, rabbits, squirrels, and on some farms, ducks and deer—to offer sport and food for you and your friends.



Fur-bearing animals like mink, muskrats, raccoons, skunks, and opossums provide recreation and cash income for you and

your family. These valuable animals occur in greatest numbers on farms that use the land wisely and provide places for them to live.

Colorful, energetic songbirds add much to the enjoyment of rural life through their music and their move-

ments. Who doesn't enjoy the songs of the mockingbird and the meadowlark—or the sight of robins busily feeding their young?

Bumblebees, leaf-cutting bees, syrphid flies, and other wild insects, formerly much more abundant than they are now, once helped farmers to produce legume-seed yields four times as high as those obtained today. Their numbers can be increased through good land management.

Large-mouth bass, bluegills, channel catfish, and sometimes trout supply fun and food for farm families fortunate enough to have a farm pond. Many farm ponds produce from 150 to 250 pounds of fresh fish per acre each year.



Wildlife Requirements

While no two kinds of wildlife have exactly the same requirements for living, it is safe to say that all kinds need food, cover, and water.



To be really useful, food must be plentiful and close to cover that will furnish protection from enemies and

weather. And it must be available in the seasons when it is usually scarce.

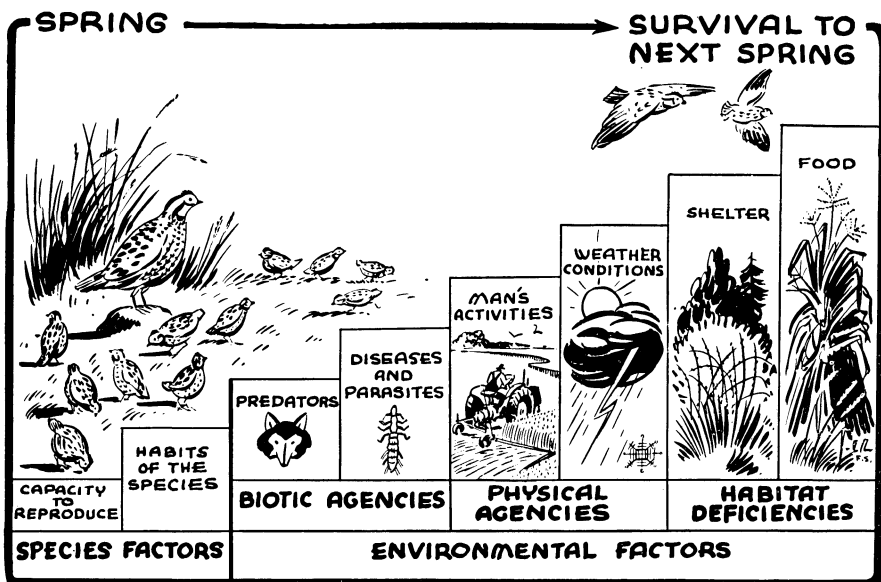
On most farm land in the United States there is enough food from late spring to fall. Insects, wild fruits, weed seeds, waste grain, nuts, or green plants are available. The critical season is winter. There are no insects. Many wild fruits are gone. Snow and ice may cover waste grain. Early spring

is often just as critical as winter.

In the South, planting perennial food-producing plants close to good cover is the best way to be sure you have enough wildlife food throughout the year. In the North, you can extend cover plantings close to natural food sources or leave unharvested a part of the grain crop close to good cover.

Most kinds of wildlife need several kinds of cover. Cover must conceal nests and young, provide shade from the hot sun and shelter from chilling rains. It must allow escape from enemies and it must protect against snow, sleet, cold, and wind in winter.





Factors that hold down wildlife populations.

Good management of cover can be boiled down to three essentials—unburned, ungrazed, unmowed grass for nesting; dense or thorny shrubs for protection from predators and for nesting; and, in the North, clumps of evergreens for winter protection. All three kinds of cover should be close together and close to available food supplies.

Wildlife obtains water from three sources: Surface water, food that contains lots of water, and dew. In the East, upland wildlife can survive on succulent foods and dew. Surface water is a necessity for all wildlife in the arid West, as it is



everywhere for water-loving species like ducks, muskrats, and mink.

In the diagram above, the factors

that hold down wildlife populations are shown as hurdles over which the birds hatched in one spring must fly if they are to survive to the next spring.

Only a few of these limiting factors can be controlled by man. The species factors are unchangeable, as is the weather. The effects of predators may be modified somewhat, but with uncertain results. Little can be done about diseases and parasites. Some of man's activities, such as time of plowing, could be changed; others, such as time of mowing meadows, cannot be altered very much. The greatest changes, fortunately, can be made in the most important factors. Success in managing land to produce useful wildlife lies in improving the amount, quality, and distribution of food, cover, and water.

Managing Land To Meet Wildlife Requirements

Land primarily suited for use as cropland, pasture, and woodland produces wildlife as a secondary crop. In addition, there is land on every farm that can and should be used to produce useful wildlife as a primary crop—it is wildlife land.

Small areas of wildlife land well distributed over the farm, when coupled with proper use and management of other land, make the whole farm an efficient unit for the production of all crops, including wildlife.

CROPLAND management practices helpful to useful wildlife include:

1. Crop rotations that included grass-legume meadow.
2. Liming and fertilizing.
3. Strip cropping.
4. Use of cover crops.
5. Stubble-mulch tillage.
6. Delaying mowing of watercourses and headlands until after grain harvest.

7. Spring plowing.

8. Leaving $\frac{1}{8}$ to $\frac{1}{4}$ acre of grain standing next to good cover.

9. Spreading manure near cover in winter.

Practices harmful to wildlife include burning, clean fall plowing, early mowing of watercourses and headlands, and indiscriminate use of insecticides and weed killers.



PASTURE LAND management practices helpful to useful wildlife:

1. Grazing within the carrying capacity of the pasture.
2. Liming and fertilizing.
3. Reseeding or renovating.

Practices harmful to wildlife include burning, grazing too heavily, and complete clean mowing early in the season.



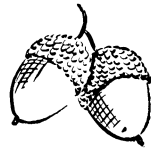
WOODLAND management practices useful to wildlife include:

1. Protection from fire and grazing.
2. Selective cutting in small woodlands.
3. Leaving two den trees per acre when cutting timber.
4. Piling brush near the edge of the woods.

5. Leaving fallen hollow logs.

6. Clear-cutting of small areas in large woodlands.

Harmful practices are burning, grazing, clear-cutting of large areas, and cutting out all den trees.



WILDLIFE LAND consists of areas, usually small, that cannot be used economically to produce other crops but that are well adapted to the production of useful wildlife. Eight kinds of wildlife land are especially important. They are: Drainage-ditch banks, fence rows

and hedges, marshes, "odd areas," ponds and pond areas, shelterbelts and windbreaks, streambanks, and wildlife borders. Their management is discussed on the following pages.



DRAINAGE-DITCH BANKS

Water is usually present in drainage ditches, and wildlife food is often available in nearby cropland. Cover added in the form of grasses and legumes makes an ideal place for wildlife to live. It also protects and prolongs the life of the ditch.

Fur-bearing animals, game birds and animals, and insect-eating song-birds will all benefit from good management of drainage-ditch banks.

Drainage ditches must be treated to protect the capacity of the channel. Siltation and bank cutting must be prevented. Plants that would slow up the flow of water must be kept out. The treatment should also make clean-out and maintenance easy.

Nearly everyone has seen drainage ditches filled with willows, cottonwoods, or other trees and shrubs. Ditches in this condition may be good for wildlife but they are not able to carry the flow of water they were designed to handle. They provide poor drainage for land that might otherwise produce good crops.

Therefore, your first aim in good drainage-ditch-bank management should be to establish and keep grass on the banks. Use grasses that offer real competition to the woody plants that would otherwise invade the ditch and decrease its water-carrying capacity.

Seeding grasses on the subsoil of steep ditch banks is often difficult. Your local soil conservationist is the man who can give you the best advice on soil treatments, kinds of grasses to seed, and seeding methods. He can also tell you

what legumes to mix with the grass.

In many places where wind erosion is not considered to be a problem, soil may be blown from fall-plowed fields by winter winds. This soil is dropped in the bottom of drainage ditches, often adding as much as 8 inches of silt in a single winter.

If you have this problem, you should plant a one- or two-row shrub windbreak. Plant it 100 feet from the center of the ditch and on either or both sides of it. You can crop the land between the ditch and the windbreak in the same rotation as the rest of the field.

Shrubs suitable for windbreaks include bush honeysuckle, Persian lilac, autumn olive, and Amur and California privets in the East; caragana, chokecherry, Russian-olive, squawbush, and wild plum in the West. On peat and muck soils, spirea has been successful.

You can keep ditch banks and berms in grasses and legumes by mowing once a year if the slopes are flat enough, by restricted grazing, or by the use of weed killers of the type designed to kill broad-leaved plants.

Do your mowing, grazing, or spraying only after ground-nesting birds have left the nest, usually about grain harvest time. Avoid overgrazing—it is important to maintain a good grass cover to prevent erosion and siltation of the ditch.

Keep woody plants out; keep good grasses in; plant windbreaks where needed; be careful to do mowing, grazing, or spraying only in late summer—that is good management both for ditch banks and wildlife.



Drainage ditches filled with trees and shrubs may be excellent for wildlife, but they cannot provide good drainage for adjacent fields.

Well-managed drainage ditches employ grasses and legumes to provide effective drainage for nearby fields and to produce useful wildlife.

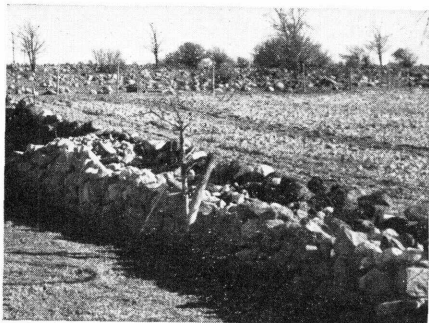




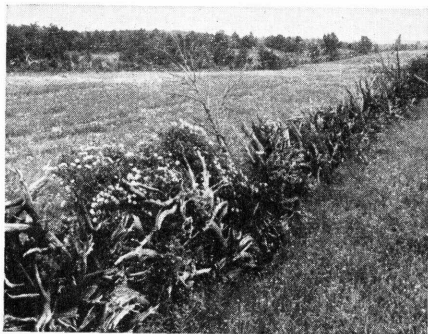
The early settlers built rail fences.



Midwestern farmers planted hedges.



Some farmers made fences of stone.



Northern settlers used pine stumps.



FENCE ROWS AND HEDGES

Fences have taken several different forms at different times and in different parts of the United States. Pioneers in wooded areas put their excess timber to work in the form of rail fences. When the midwestern prairies were being settled, something else had to be found—timber was scarce there. Osage-orange hedges were the ingenious solution in many places. In some areas, farmers disposed of unwanted stones and stumps by using them to build fences.

All of these kinds of fences were helpful to wildlife because they provided cover of one kind or another close to the farmers' fields where food could be found.

Then came the invention of the barbed- and woven-wire fence, easier to construct than any of its predecessors and less wasteful of valuable cropland. Soon it was used almost universally, but, unless the landowner allowed native shrubs to grow in it, the wire fence furnished no cover for wildlife.

Now, a new kind of fence is gaining popularity. It is the living fence of multiflora rose. It promises to be a real boon to wildlife.

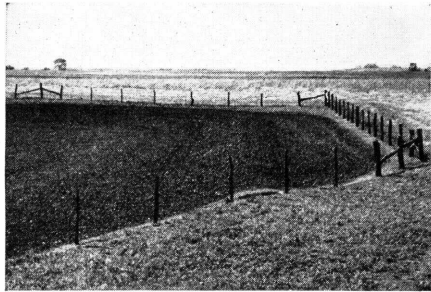
At the same time many old ideas about the necessity for maintaining "clean" fences in order to control insect pests or weeds are going out the window. Modern studies of wildlife relationships are showing that woody fence rows have many advantages for the farmer.

Woody fence rows have been shown to harbor fewer harmful and more beneficial kinds of wildlife than do grassy fence rows, on general farms. On truck farms and farms producing small fruit and orchard crops, woody fence rows may be hazardous because they may harbor insects detrimental to these crops and may help spread diseases common to woody plants. The danger is slight, however, if recommended spraying programs are carried out.

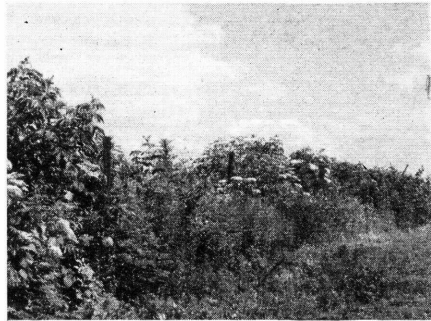
Woody fence rows fit best where fence lines will not be changed, as between cropland and pasture, along property boundaries and streams, or around large gullies, ponds, and odd areas. Hedges are being used more and more extensively as contour guide lines between crop fields or on terraces and diversion dikes.

Multiflora rose is definitely the outstanding shrub for use in fence rows and hedges wherever it can be grown. It is capable of forming a living fence that requires no wire, needs no hard-to-maintain braces to follow contour lines, does not require trimming or pruning. It is fast-growing and attractive, makes good wildlife cover, and has some value as an emergency wildlife food. For more detailed information about multiflora rose see U. S. Department of Agriculture Leaflet 256, Multiflora Rose for Living Fences and Wildlife Cover.

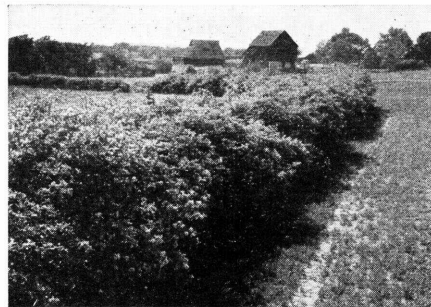
Where multiflora rose cannot be grown, one of the following shrubs will produce good hedge or fence-row cover: Red cedar, gray dogwood, American hazelnut, bayberry, silky cornel, highbush cranberry, bush honeysuckle, autumn olive,



Wire fences offer no wildlife cover.



Native shrubs improve wire fences.



Living fences need no wire or posts.



Contour hedges save soil and game.

Russian-olive, sand cherry, wild plum, trifoliate orange, or squawbush. Ask your local soil conservationist for suggestions.

These shrubs will not tap soil moisture to reduce yields of adjacent crops; neither will they shade crops appreciably.

When planting living fences of multiflora rose or hedges of other shrubs it is important to start right with thorough ground preparation. Mark the location with stakes, then plow a backfurrow, making two rounds with a two-bottom plow. Smooth with a harrow.

In the North, open a new furrow on the ridge of the backfurrow in the spring, then set the plants, holding them in place with a handful of soil. Then plow another furrow to cover the roots completely. Pack soil around the roots with the tractor wheel. In the South, fall or winter planting is better.

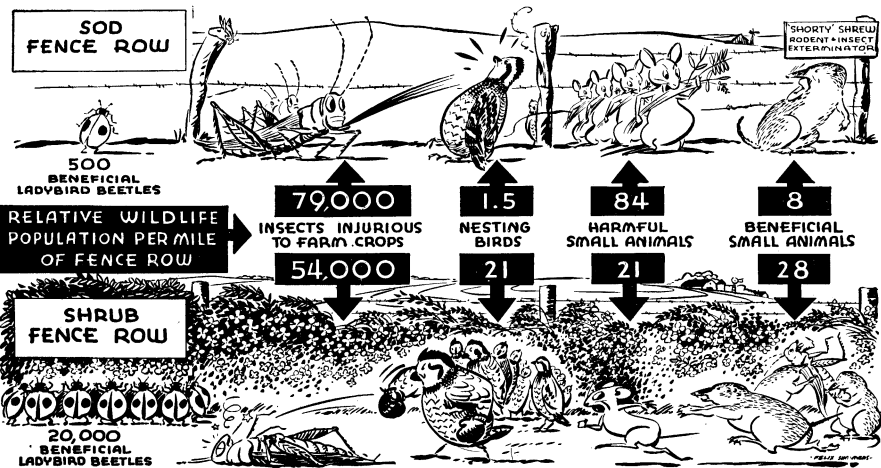
You can speed the growth of your hedge by plowing down 1 pound of

complete fertilizer, such as 5-10-5 for every 40 feet of row. Shrubs also respond well to mulching. Use strawy manure, plain straw, old stack bottoms, sawdust, wood chips, or stalks. If you have no mulching materials, cultivation the first 2 years is essential, especially in the West. If your hedge runs up and down hill, you should be sure to use mulch instead of cultivation. Otherwise you are likely to have excessive erosion.

For fence rows in which you don't want to grow shrubs, you can make an improvement for wildlife with sericea lespedeza or sweetclover. Simply throw a furrow to the fence row in the fall. In late winter or early spring broadcast 30 pounds of sericea (see page 29 for range) or 15 pounds of sweetclover per acre.

Existing fence rows composed of shrubs, trees, and vines can be made neat in appearance, and the competition with crops can be reduced by cutting out the trees.

Compare sod with shrub fence rows for useful and harmful wildlife.



• LET SHRUBS GROW IN YOUR FENCE ROWS • CUT OUT TREES AND VINES • PLANT LIVING FENCES OF MULTIFLORA ROSE

MARSHES

On many farms throughout the United States there are areas of wet land where drainage would not produce ordinary farm crops profitably. Some of them, particularly small potholes from $\frac{1}{4}$ to 5 acres in size located in the Northern States, are valuable producers of waterfowl. Large areas of coastal marsh in the East and South are important wintering grounds for ducks and geese.

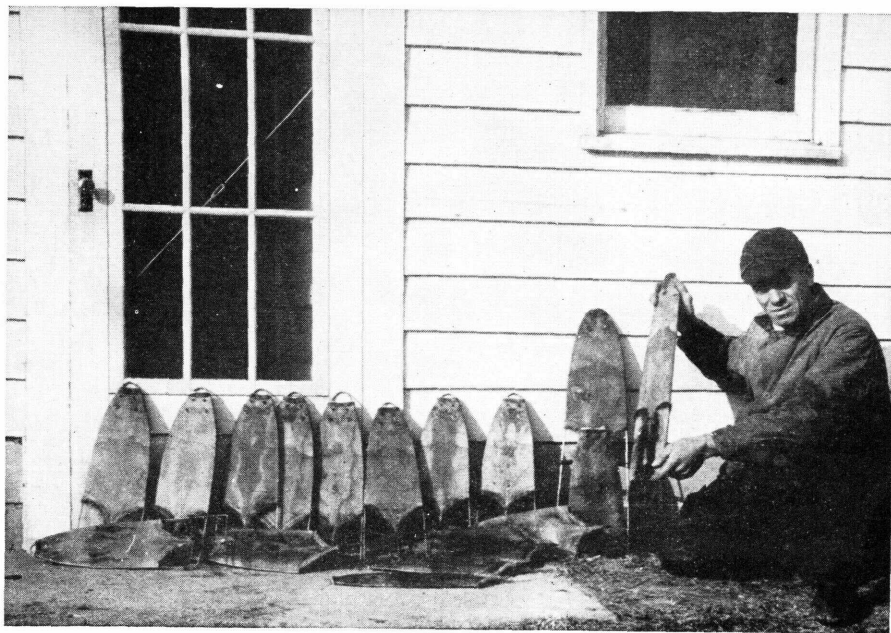
Many of these marsh areas are worth little for wildlife or any other crop in their present condition. Marsh management provides an opportunity to improve the land use and productivity of such areas. Many wet-land areas, when properly treated and managed, will produce

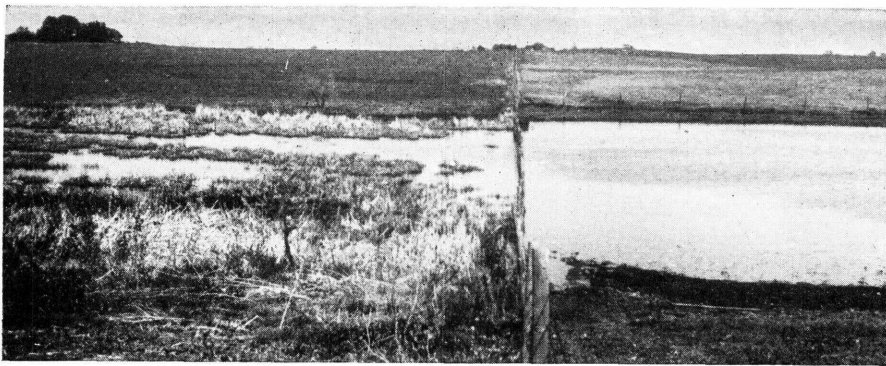
an annual catch of 6 to 15 muskrats per acre. Others can be made productive for waterfowl as well as muskrats, mink, raccoons, pheasants, prairie chickens, and songbirds.

Generally, you should manage marshes either for fur-bearing animals or for waterfowl. If managed for one they will be somewhat useful for the other, but you cannot have best conditions for both on the same area. In either case, two requirements must be met: (1) A dependable water supply and (2) the right kinds and amount of vegetation for food and cover.

For small marshes, the simplest management is prevention of grazing and uncontrolled burning. Marsh plants make better food for muskrats and waterfowl than for

Managed marshes produce high profits on moderate investments.





Keeping livestock and uncontrolled fire out of marshes is good business.

livestock. Grazing destroys valuable food and cover.

Northern marshes should have 6 inches or more of water for at least 3 months in spring and early summer. If yours does not, you can improve it for waterfowl by blasting one or more holes about 30 feet in diameter and 2 to 3 feet deep.

If you have a marsh larger than 5 acres that has a reliable water supply from a stream or a strong spring flow, you may be able to improve it by controlling the water level. You will need engineering help to find out if a water-level-control structure can be built at low cost.

To manage a northern marsh for muskrats by controlling the water levels, you will want to maintain water levels at about 6 inches during the summer to encourage the growth of muskrat foods. You will want to raise the water level to about 2 feet in the fall and hold it there over winter to prevent the marsh from freezing to the bottom. If not already present you may wish to plant cattail, bur reed, arrowhead, or bulrush to make the marsh productive

as quickly as possible.

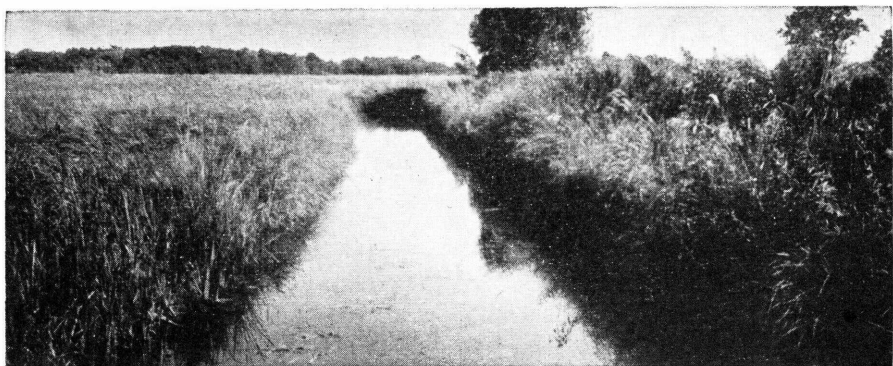
To manage a marsh for waterfowl by controlling the water levels, you have two choices. One method is to draw the water down enough to keep the soil moist, but with no water on the surface, during the growing season. This will favor growth of smartweed, bur reed, wild millet, and other good waterfowl food plants.



The water level should be raised to about 18 inches in the fall to make the marsh attractive to waterfowl. This method is best for

the South, but it does not provide nesting for waterfowl or homes for muskrats.

The other method is to maintain the water level at depths between 18 and 30 inches throughout the season, holding it at 18 inches in the fall. This method will favor the growth of waterfowl food plants such as wild celery, pondweeds, arrowhead, duckweed, and muskgrass. These are good waterfowl foods and some of them are useful for muskrats too.



Level ditches hold enough water to make shallow marshes productive.

If you have a marsh larger than 5 acres that does not have a reliable surface-water supply but that does have a water table that keeps water within 1 foot of the surface, you may be able to improve it with level ditches. You will need help from your local soil conservationist to find out if your marsh has soils suitable for ditching and to determine the best arrangement for the ditches.

Level ditches should be 5 to 6 feet deep in the North, 4 to 5 feet deep in central United States, and 3 to 4 feet deep in the South.

They should be dug only in marshes having peat or soils of loam or heavier texture to the recommended depth of the ditch. Do not attempt level ditching in marshes having sandy loam or lighter soils within the depth recommended for ditches.

Level ditches should be 12 to 20 feet wide. They should be level so that water will not flow in them. If they cannot be made exactly level, they should be blocked at intervals to prevent drainage.

Spoil banks should be 3 to 4 feet

high and should be thrown up on the north or west side of the ditch.

Ditches should be dug 100 to 400 feet apart. A 100-foot spacing will produce the most muskrats. But a 200-foot interval will result in the most income per dollar invested.

The management discussed so far is recommended for inland marshes. Coastal marshes require special consideration because of the possibility of changing the salinity of the water and its effects on vegetation. Be sure to get help from a soil conservationist before attempting ditches or controlled water levels on coastal land.

Recent studies in Wisconsin have shown that the improvement by level ditching of peat marshes having water levels of $\frac{1}{2}$ foot in winter is economically sound. The additional net income after ditching was enough to pay for the ditches in 2 years.

Muskrats should be trapped heavily—you should take 60 to 70 percent of the population each year.



ODD AREAS

Small pieces of "waste" land that can be changed into wildlife land are called odd areas. They include small eroded areas in crop fields, bare knobs, sinkholes, small sand blowouts, large gullies, abandoned roads and railroad rights-of-way, borrow pits, gravel pits, or even bits of good land that are cut off from the rest of a field by a stream, drainage ditch, or gully. To be useful for wildlife, odd areas should be at least $\frac{1}{4}$ acre in size. They may be as large as 20 acres in the West. In the East, areas of more than 3 acres could be used to produce timber crops, using only the edges for wildlife production (see page 27). In parts of the West where trees and shrubs cannot be grown, native grasses are used to develop odd areas for wildlife.

For high wildlife production in the East, a good mark to shoot at is one odd area or other wildlife development per 20 acres of land.

Some odd areas are already in

vegetation that produce good wildlife food and cover—they may need little or no improvement except protection from fire and grazing. Others may provide nesting cover but no winter cover. In the North, they can and should be improved by adding suitable conifers—pines, spruce, cedars. In the South, where snow is not frequent and temperatures seldom fall below freezing, the conifers for winter cover are not needed.

Most odd areas need better ground cover and food. You can make them produce more wildlife by managing them to supply all the requirements for at least one kind of wildlife in which you are particularly interested.

Be sure to leave at least half of your odd area in good ground cover of grasses and legumes. The most common mistake made in developing odd areas in the past has been to overplant them to woody plants without leaving enough land in grasses and legumes. Good ground cover not only benefits ground-nesting birds but is very useful for

Multiflora rose is emergency food.



Bush honeysuckle fruit is bright red.



cottontails. They need it on cold nights. Bobwhites and pheasants need it day and night.

If the odd area you want to improve has no food or cover present, you will need to add everything. In the North, you might well start by providing winter cover in the form of adapted conifers in the center of the area. Plant 25 to 50 in a solid clump. Space them about 8 feet apart so they will retain their lower limbs and keep good cover close to the ground as long as possible.

Next, by surrounding the conifers with one to three rows of fruit-producing shrubs, you can supply some food and nesting cover for some songbirds. These might include multiflora rose, thornapple, and blackberry, all of which are thorny and would make good escape cover too. Multiflora rose would also provide emergency food for pheasants. Highbush cranberry, Russian-olive, autumn olive, gray and silky dogwoods, bush honeysuckle, bayberry, chokecherry, and

wild plum are all fruit producers that would supply some food in fall and would be useful for nesting songbirds.

If you want to increase bobwhites and if you live south of U. S. Highway 30 and east of the Ohio-Pennsylvania line or south of Highway 40 and east of the Great Plains you should include $\frac{1}{8}$ acre of bicolor lespedeza in your odd areas.

Plant your shrubs 3 to 4 feet apart to get a good thicket. Plant bicolor in rows 3 feet apart with the plants 2 feet apart in the row.

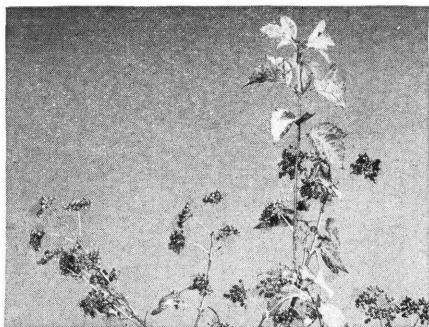
Working out from the shrubs, you will want to have at least one-half of the area in nesting cover for bobwhites and other ground-nesting birds. If native grasses are sparse, you can sow a mixture of adapted grasses with either sericea lespedeza (see page 29 for range) or sweetclover. Don't try to get too heavy a stand—nesting birds like to be able to see what is coming their way. If your soil is acid you will need to apply lime before seeding sweetclover.

Wild plum fruit makes jam and jelly.

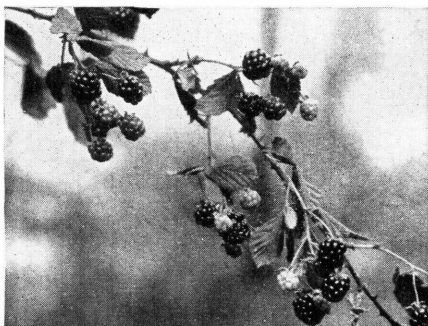


Gray dogwood has nutritious fruit.





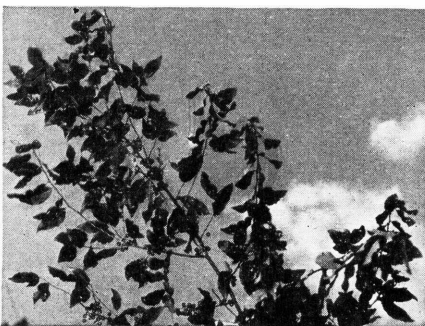
Highbush cranberry; northern shrub.



Blackberries are high in moisture.



Russian-olive feeds western wildlife.



Autumn olive feeds game in the East.

Sow sericea lespedeza at the rate of 30 pounds per acre and sweet, clover at the rate of 15 pounds per acre. You don't need as good a seedbed at these rates as you would prepare for a meadow seeding of alfalfa or red clover.

To keep livestock out of your odd area, you can add a living fence of multiflora rose. If you live in the North or in other areas where multiflora rose will not grow, you will need a wire fence—the kind will depend on the type of stock you plan to have in the vicinity.

If you live in the pheasant-producing area west of the Mississippi River and want to increase pheasants, you will want to make your odd area planting in the form of a windbreak. Plant two rows of such hardy shrubs as wild plum, sand cherry, Russian-olive, or bush honeysuckle on the west and north sides. Then sow a strip 100 feet wide to sweetclover and plant a block of at least 100 conifers or hardwood trees like green ash, soft maple, or boxelder in the southwest corner. This type of planting should be at least 1 acre in size to provide the winter shelter and the nesting cover needed in that area.

If you live east of the Great Plains, you can often depend on nature to provide native shrubs in odd areas that are protected from fire and grazing. That means all you need to plant are the conifers, the multiflora rose, and the sericea lespedeza or sweetclover.

If your odd areas already contain some of the food- and cover-producing plants listed, there is no need to plant more. Just fill in the kinds of plants that are absent.



PONDS

Ponds are constructed for one or more of the following purposes:

1. Soil erosion and flood control.
2. Water storage for livestock, supplemental irrigation, orchard spraying, or fire protection for farm buildings.
3. Fish production.

In addition to fish, they can be expected to provide water and cover for fur-bearing animals, game birds and animals, and songbirds.

Ponds must be located on relatively tight subsoils or they will not hold water. They are usually built in small valleys with steep sides and gradually sloping floors so they will hold an adequate amount of water without excessive height in the fill. They should be placed where they will contribute to sound land use on the rest of the farm and where they will be free from excessive siltation.

The water supply for most ponds comes from water running off the land. The size of watershed needed varies according to local rainfall, topography, type of cover, and rate of evaporation. The entire watershed should be in ungrazed woods or improved permanent pasture or range. Cropland in the watershed shortens the life of the pond by allowing too much silt to get into it. Springs are often suitable sources of water supply, but running streams should be avoided. They carry too much water and silt and it is difficult to keep stream fish out of the pond.

For details of farm pond construction, see USDA Leaflet 259, *How to Build a Farm Pond*. But ask your local soil conservationist for advice. You will profit from his local experience and knowledge.

On most farms, the pond should be fenced to keep out livestock. This is important to help prevent

the spread of livestock diseases; to protect the fill, spillway, and pond edges from trampling; and to provide a filter strip to remove silt from the water before it reaches the pond. Fencing will also allow you to make plantings useful for upland wildlife.

In areas where it can be grown, multiflora rose should be used to establish a living fence as shown in the drawing. Also plant a few clumps of conifers and shrubs. Use the same species and spacings suggested on page 15.

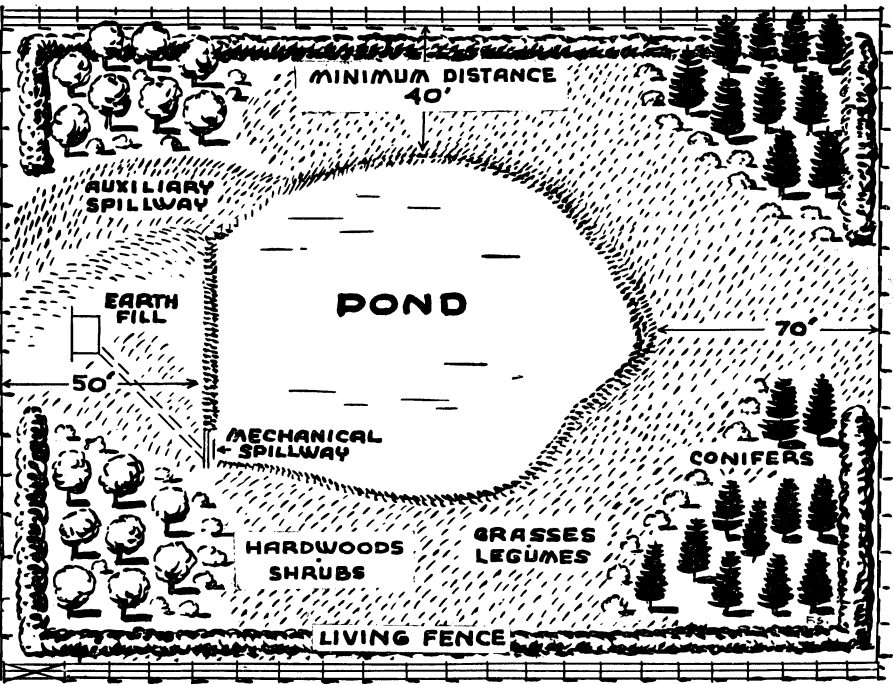
All raw areas above the water line should be seeded to adapted grasses and shallow-rooted legumes such as alsike clover, red clover, Korean or common lespedeza. Never plant trees, shrubs, or deep-rooted legumes like alfalfa, sweetclover, or sericea lespedeza on the fill. Use lime, fertilizer, and manure as needed.

If you want to manage your pond for fish production, don't plant anything in the water. Keep woody plants back at least 15 feet from the water's edge to allow plenty of room for fishing.

If you don't care about fish but want to attract muskrats and waterfowl to your pond, you can plant a few cattails, arrowhead, bulrushes, or bur reeds. These, or other native water plants, will frequently come in naturally if no planting is done. In shallow water they may become so thick as to be a nuisance.

For fish production your pond needs to be at least $\frac{1}{4}$ acre in surface area if you plan to fertilize systematically. If you don't plan to use fertilizer your pond should have a surface area of at least $\frac{1}{2}$ acre.

In the North, ponds should average 10 feet in depth and should



have $\frac{1}{4}$ of the pond 12 to 14 feet deep. In the Central States, ponds should average 6 feet in depth with $\frac{1}{4}$ of the area 8 to 10 feet deep. In the South, they should be at least 6 feet deep in the deepest part.

Ponds for fish production should be built so they are 3 feet deep within 10 feet of the shore line.



This helps control water weeds and mosquitoes and permits bass to reduce the number of small fish effectively.

Farm ponds may be stocked with fish as soon as the water approaches the spillway level.

If you want pan fish, large-mouth black bass and bluegills make the best combination. They must be stocked together because neither species is satisfactory alone. Bluegills, stocked alone, quickly overpopulate the pond with stunted fish. Bass, stocked alone, turn cannibalistic and produce a low yield. They must feed on other fish for maximum production.

In most States, 50 bass fingerlings and 500 bluegill fingerlings per acre are stocked in unfertilized ponds. In fertilized ponds, the stocking rate may be increased to 100 bass and 1,000 bluegill per surface acre.



An equal number of channel catfish may be substituted for one-fourth of the bass or that number may be stocked in addition to the bass and bluegills after the bluegills have become established. Channel catfish seldom spawn in farm ponds; they must be replaced occasionally.

Fish such as crappies, bullheads, and green sunfish generally have not been satisfactory either alone or in combinations.

In spring-fed ponds where the summer water temperature will not exceed 75° F., brook or rainbow trout may be stocked at the rate of 300 to 400 fish per surface acre. No other game fish should be stocked in trout ponds, but fathead minnows can be used as forage fish. Rainbow trout do not reproduce in ponds; they must be restocked periodically. Brook trout may reproduce in ponds that have a gravel bottom spring run.

Bass, bluegill, channel catfish, and trout fingerlings can be secured from hatcheries of the U. S. Fish and Wildlife Service, some State conservation agencies, or commercial hatcheries.

Most farm ponds are not fished heavily enough. Fishing for bluegills should begin the first



summer after stocking. Bass should not be taken until they have reproduced; usually the first summer in the South but most likely the second summer in the North.

It is not good management to throw back any fish caught on hook and line except undersized bass. Bluegills should never be returned to the water, regardless of size.

Neither is it good management to fish selectively for bass. Generally, three-fourths of your total pounds of fish are bluegills. A good rule of thumb would be to harvest 3 to 4 pounds of bluegills for every pound of bass. Good bass fishing is a reward for heavy bluegill fishing.



Fertilizing a farm pond is easy.

You can catch bluegills most easily on a small hook (size 8 to 12), baited with crickets, grasshoppers, earthworms, white grubs, catalpa worms, or a small piece of shrimp. Your hook should be attached to a 3-foot gut or nylon leader, which in turn is attached to the line. The baited hook should be allowed to settle to the bottom of the pond; then you should pull it back slowly, moving the bait about an inch at a time. Bluegills bite best in summer and fall.

Ponds are ideal for family picnics.



In the hands of a skilled fisherman, artificial flies (size 10 to 14) with light tackle will catch many bluegills and provide the ultimate in fishing enjoyment.

The best place to fish for bluegills is on the spawning beds, which you can see in clear water or can locate by fishing in highly fertile water.

Bass are best caught with minnows or artificial bait. A "popping bug" on a fly line will give you a thrill when a bass takes it. Plugs or spinners used with a casting rod are also good. And, of course, minnows are the "old reliable." Bass fishing is best in spring, may be poor in summer.

You will often have to try several kinds of bait to find out what is most attractive to the fish at any particular time.

In States where they may be used legally, fish traps and seines will help you harvest the fish crop that should be taken,

Fertilizing farm ponds is often necessary for maximum fish production. A highly fertile pond will support more pounds of fish than one of low fertility. Experiments in the Southeast show that unfertile ponds support less than 100 pounds of fish per acre, average ponds support 150 pounds, highly fertile ponds support 400 pounds.

Fertile water shades out submerged weeds. It is greenish and opaque, because innumerable tiny plants are present. Light does not go any deeper into such water than you can see. Weeds cannot grow without light. Although some people may object, it is perfectly safe to swim in fertile water.

Fertilizing costs money—\$10 to \$30 per acre per year. It will pay you dividends only if you fish the pond heavily or if you need to control water weeds.

Fertilizing must be done systematically. Good results cannot be obtained by haphazard methods. Fertilizing, once begun, must be continued because the fish in the pond quickly put on weight when it is started. If fertilizing is stopped the amount of fish food is sharply reduced and the fish must lose weight to get down to the lower amount of food present.

If you plan to use fertilizer, you should apply it at 1- to 2-week intervals beginning early in the spring. Continue to apply it until the water becomes so cloudy that you can't see the bottom in water that is 12 inches deep. Additional applications should be made until frost whenever the water begins to clear.

Each application of fertilizer should consist of 100 to 200 pounds per surface acre. You need nitrogen and phosphorus in about equal parts with one-half to one-fourth as much potash. Desirable formulas are 8-8-2, 8-8-4, 10-10-5, or 12-12-6. If you cannot buy these, your soil conservationist, county agent, or fertilizer dealer can tell you how to mix locally available fertilizers to get a satisfactory formula.

Muddy ponds can be cleared by applying 2 tons per acre of barnyard manure or partly cured hay, straw, or weeds at 2-week intervals. When the pond has cleared and the source of silt corrected, start using inorganic fertilizer again. Acid

ponds may be cleared by applying 50 pounds of slaked lime for each acre-foot of water.

Controlling weeds in ponds is necessary for good fish production. Fertilizing is the most practical way to control underwater plants. Plants growing around the shore line are best removed simply by pulling them out as fast as they get started. Two or three hours a month spent at this task will usually provide satisfactory control.

Winterkilling of fish in northern ponds may occur when snow accumulates on top of the ice. The only



All-purpose ponds may attract ducks.

practical recommendations for its control are to remove the snow from part of the pond surface or to lower the water a few inches below the ice to admit air.

Farm ponds can furnish a lot of pleasure—swimming, fishing, hunting, and, in the North, skating. But they will do so only if they are well planned, well constructed, and well managed. Farmers' Bulletin 1983, Farm Fishponds for Food and Good Land Use, will give you more hints on pond management.

SHELTERBELTS AND WINDBREAKS

Shelterbelts are planted in crop fields to help control wind erosion and lessen the drying effect of wind on the soil. They conserve snow moisture needed in low rainfall and light soil areas.

Because of the large amount of "edge" in relation to acreage, shelterbelts are especially valuable in providing wildlife cover. They create homes for insect-eating birds close to cropland, where they can do the most good. They provide cover and travel lanes for game.

Windbreaks are planted around farm buildings to protect them from winter wind and snow. They are much used by wildlife, being very important to pheasants in winter.

Two kinds of shelterbelts are used in various parts of the United States. In the prairie areas shrub-hardwood shelterbelts are most common; in the formerly forested sections of the country, pine shelterbelts are used most.

Both kinds are planted at right angles to the prevailing wind, usually north and south.

For either shelterbelt, you should prepare the ground thoroughly in the fall before planting. Plow and harrow it in the fall and then harrow it again in the spring.

Shrub-hardwood shelterbelts usually consist of from 4 to 12 rows. In 4-row shelterbelts, the outer 2 rows are shrubs and the inner 2 rows are hardwood trees. Shelterbelts containing 8 or more rows should have shrubs in the outer 4 rows.

You can choose from any of these

shrubs: Bush honeysuckle, Amur or California privet, and multiflora rose in the East; wild plum, sand cherry, Russian-olive, desert willow, buffalo berry, and squawbush in the West. Red cedar, or shortleaf or Austrian pine may be substituted for shrubs on the windward side.

Hardwood trees you can use in shelterbelts, depending on your locality, include American elm, green ash, soft maple, black locust, hackberry, honey locust, Chinese elm, mulberry, catalpa, apricot, cottonwood, and willow.

Plant shrubs about 4 feet apart in the row with the rows 8 to 10 feet apart. Hardwoods are planted 8 to 10 feet apart in the row with rows 8 to 16 feet apart. Use the wider spacing with wide-spreading trees like cottonwood and for all species in low rainfall areas.

Conifer shelterbelts consist of three or more rows, using Austrian, jack, red, Scotch, shortleaf, or white pines, Norway or white spruce in rows 8 to 10 feet apart. Space the trees 6 to 8 feet apart in the row. Shrubs may be used to flank the trees as in the hardwood type.

You should protect both kinds of shelterbelts from fire and grazing at all times.

Both should be cultivated regularly the first 2 years. Survival and growth of your trees will be much better.

You may plant windbreaks using the same species and spacings as in shelterbelts. Windbreaks are usually placed on the north and west sides of the farmstead. Be sure to keep them at least 100 feet away from the buildings to keep snow from drifting into the farm yard.



Shrub-hardwood shelterbelts save western soil, moisture, and wildlife.

Pine shelterbelts control wind erosion and aid wildlife in the East.



STREAMBANKS

Streambank protection is undertaken to control bank cutting, protect valuable adjoining property, and reduce the silt load in streams. It is one of the best ways to improve wildlife conditions because it usually provides food, cover, and water



close together. It also improves the stream for fish. It benefits fish, fur-bearing animals, game birds and animals, and songbirds.

Streambank work done on any part of a stream will be affected by the condition of the stream both above and below the part being treated. Therefore, it is always desirable to treat the entire length of a stream at one time. If that can't be done, try to work from the headwaters on down.

Before you start treatment of any streambank, you should consider several things. These include size of the watershed draining into the stream, expected runoff and flood peaks, expected ice and debris load to be carried by the stream, and causes of meandering and erosion.

The most common causes of streambank erosion are: Overgrazing; fallen trees that deflect water from its normal direction of flow; trees or brush growing on the *inside* of a curve that deflect water against the cutting bank. Water from a smaller stream entering the channel may deposit sediment that pushes the water against the eroding side.

The first, and often the most

difficult, thing to do in treating a streambank is to protect the stream from grazing. If stock water is needed, you can provide watering places where livestock will not have to cross a steep bank. You may wish to provide more than one watering place. You can then use them alternately to prevent stock from killing all the vegetation.

Next, correct the causes for meandering. Remove fallen trees and trees and brush on inside curves. Eliminate the sediment carried by small streams through conservation practices on their watersheds or by desilting dams in their channels.

For small streams up to 6 feet wide with low banks 3 to 4 feet high and watersheds of not more than 2 square miles, protection from grazing is often all that is needed. If, after 2 years of protection from grazing, there still are raw eroding curves, you can treat them as suggested in the next paragraph.



For medium-sized streams 6 to 12 feet wide with banks not more than 10 feet high and with watersheds of less than 10 square miles, some kind of mechanical protection is usually needed. You can drive in willow poles, on the cutting side only, at or just above the water line in a double row. The poles should be 2 to 4 feet apart and staggered between rows. They should be 6 to 8 feet long and 2 to 4 inches in diameter and cut from brush-type willows. Purple-osier willow is one of the best.

About two-thirds of the pole should be driven below the ground

line. The poles should be supplemented by planting willow cuttings at a spacing of 2 by 2 feet, using shrub-type willow.

There is another method you can use on medium-sized streams. On eroding curves (upper picture), slope the bank to the point where there is 1-foot drop in 1-foot horizontal distance. Shingle the bank with bundles of brush-type willows, placing the butt ends below the water line. Drive willow stakes into the bank and lay willow poles across the bundles of brush. Fasten the poles to the stakes with No. 9 wire (center picture).

Riprapping the toe of the bank with rocks (center picture) is very important to prevent undercutting.

For large streams more than 12 feet wide with banks more than 10 feet high and with watersheds of more than 10 square miles, a more intensive type of treatment must be carried out. The same thing is true where the safety of high-value improvements such as farm buildings or highways are threatened.

On all large streams, be sure to secure engineering assistance to locate and construct brush and rock wing dams, pile wing dams, timber cribs, or tree revetments. Wherever you install such structures you should plant willow cuttings between them to provide the permanent protection that only living trees can assure.

On all types of streambank improvement, much of the value for wildlife comes from the planting of moisture-tolerant shrubs and trees between the bank and the fence.

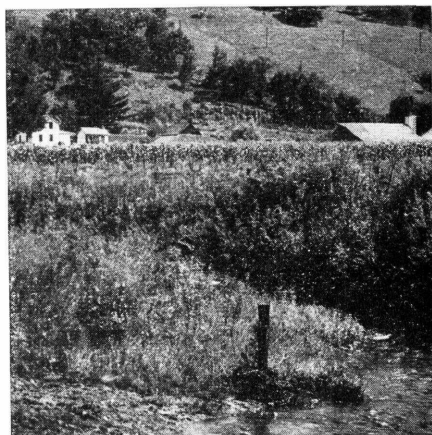
Shrubs that you can use in such situations include red-osier dog-



Erosion on an overgrazed streambank.



Same bank covered by willow bundles.



Riprap and growing trees protect bank.

wood, gray dogwood, silky cornel, Russian-olive, nannyberry, and highbush cranberry. Multiflora rose living fences may be planted as a permanent fence along the top of the streambank.

White pine, yellow pine, Northern white cedar, Rocky Mountain juniper, and Norway spruce are conifers you can plant for winter cover.

All types of streambank control that involve the use of willows will require maintenance. Better protection will be obtained if you cut the willows periodically to keep the stems small and pliant so they will bend over and "shingle" the streambank during periods of high water. Willows and other trees growing on the bank proper should always be cut out as soon as they become 2 inches in diameter.

Debris lodged against the banks during floods should be removed as soon as the water returns to

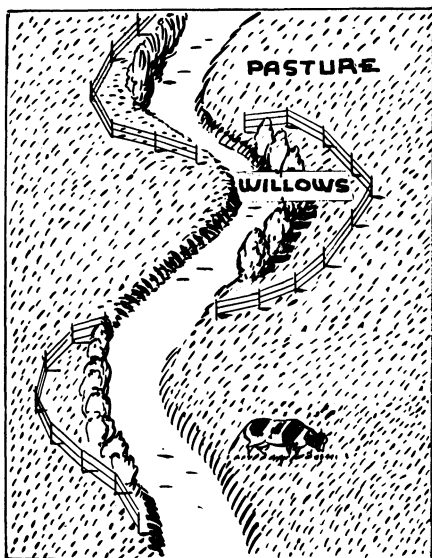
normal flow. It is particularly important to keep brush cut down on inside curves. If you do this job once a year, it need not become burdensome.

Sediment in streams is very destructive to fish. It covers spawning beds and valuable food organisms. It causes mechanical injury to the gills of fish. Sediment is the product of erosion on the entire watershed of the stream.

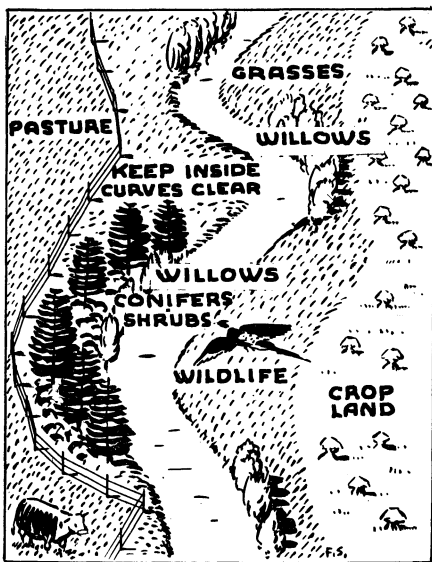
The measures described here can only control erosion on the streambank itself. *Before they can do the job they are capable of doing to improve fishing on your stream, erosion on the entire watershed must be satisfactorily controlled.*

Ask your local soil conservationist to help you develop a complete erosion-control plan for your farm. Only in that way can you get full value from your streambank work.

How to protect from grazing streams having deep water and high banks.



How to protect streams having shallow water and low banks.





WILDLIFE BORDERS

Wildlife borders are used to control erosion and to make use of narrow strips of land in which satisfactory grain crops are hard to grow. They are also used in places where perennial plants are needed for special purposes.

In different parts of the United States, wildlife borders are established in one or more of the following situations: As turnrows along the edges of cropland fields; in sapped areas such as those where cropland is next to woodland, tall shelterbelts, or windbreaks; along streams or ditches; around waterways, wet spots, or gullies; along farm roads; above diversion dikes; and for confinement strips to keep Bermuda grass from spreading into cropland fields.

There are really two types of wildlife borders: Those made up of grasses and legumes and those of shrubs or shrubs and conifers.

Legume-grass borders make farming easier by giving you a headland on which to turn farm machinery.

Shrub or shrub-conifer borders protect your woodland from drying winds and prevent the loss of leaf mulch. This conserves moisture and helps the trees grow faster.

Both types of wildlife borders benefit useful wildlife by providing either food or cover—sometimes both. The cover they furnish is next to cropland where food is sometimes available and the food they produce is often next to woodland where cover can be found.

Wildlife borders help you produce more insect-eating songbirds, more game birds and animals, and more pollinating insects on your farm.

You can establish legume-grass borders most easily when you are seeding the entire field to meadow. You can use any combination of locally adapted grasses and legumes.

When you plow up your meadow for clean-tilled or grain crops, leave a border about 1 rod wide unplowed. You can leave it unplowed indefinitely as long as a good sod remains. When the sod is no longer satisfactory, you can plow and reseed the border the next time you seed the field to meadow.

Since legume-grass borders occupy such small acreages and since undisturbed nesting cover is one of the greatest needs of ground-nesting birds and rabbits, it is suggested that you leave them unmowed. If weeds must be controlled, delay mowing until after grain harvest if at all possible. By that time most young birds will be out of the nest.

If you live east of the Great Plains and south of U. S. Highway 40 in the Midwest or US 30 in the East you can establish bicolor lespedeza borders around your woods. Bicolor lespedeza is one of the best bobwhite foods known. A $\frac{1}{8}$ -acre strip will winter a covey of birds.

You can start a bicolor border by planting 1-year-old seedlings. You should plant 5 rows, 3 feet apart, with the plants spaced 2 feet apart in the row.

You can also start a bicolor border by direct seeding. Prepare a good seedbed as you would for alfalfa or red clover. Sow 20 to 30 seeds per foot in each of 5 rows spaced 2 to 3 feet apart. Or you can broadcast the seed at the rate of 10 to 16 pounds per acre. Use scarified seed. Cover the seed about $\frac{1}{2}$ inch and firm the seedbed with a cultipacker if you have one available.

Legume-grass field borders control erosion and produce useful wildlife.



To be sure you will get enough seed to feed your bobwhites well, apply 400 to 800 pounds per acre of 0-12-12 fertilizer at the time of planting or seeding.

You should cultivate row plantings at least twice during the first year. They won't need cultivation after that.

Bicolor lespedeza is a perennial legume—you won't have to plant or seed it more than once. If you want more information about this valuable plant, see USDA Leaflet 248, Bicolor Lespedeza for Quail and Soil Conservation in the Southeast.

In many parts of the Southeast and as far north as southern Iowa, southern Michigan, and southern Pennsylvania, you can establish good wildlife borders around woodlands by seeding sericea lespedeza. Used alone, it is not as valuable for quail food as bicolor. Used in combination with bicolor, it provides a turnrow and makes excellent cover. It is good cover for quail, rabbits, and many other kinds of wildlife. Like bicolor, it is a perennial legume that needs to be sown only once.

To establish sericea lespedeza, prepare a good seedbed, broadcast scarified seed at the rate of 20 to 30 pounds per acre, and then cultipack. Sericea lespedeza frequently makes a slow start. What appears to be a seeding failure may make an excellent stand if left undisturbed until the second or third year. You can speed growth by applying 400 to 800 pounds of 0-10-20 fertilizer per acre at the time of seeding.

Many landowners wish to protect woodlands from grazing by using living fences of multiflora rose. Since the rose does not grow well in shade, you should plant it at least 20 feet away from the edge of the woods. The space in between should be planted to bicolor lespedeza, sericea lespedeza, or one of the shrubs listed below. These plants will provide competition for tree seedlings that might otherwise get started in this strip. They will delay the day when the woods will reach out to overtop the living fence. If you don't make a planting such as that described here it may be necessary for you to "brush out" this strip from time to time to keep your living fence effective against livestock.

If you live north of the area where the lespedezas are adapted, you can get good wildlife borders along your woods by planting shrubs like bush honeysuckle, gray or silky dogwood, American hazelnut, autumn olive, wild plum, thornapple, nannyberry, or highbush cranberry.

For a good border, plant four rows, 4 feet apart in the row. Plant the taller shrubs (wild plum, autumn olive, thornapple, nannyberry, and highbush cranberry) next to the woods. Put the lower growing species (honeysuckle, dogwood, and hazelnut) in the two outer rows. In the North, jack, red, Scotch, or white pine, or Norway spruce may replace the taller shrubs, thus helping to provide needed winter cover.



